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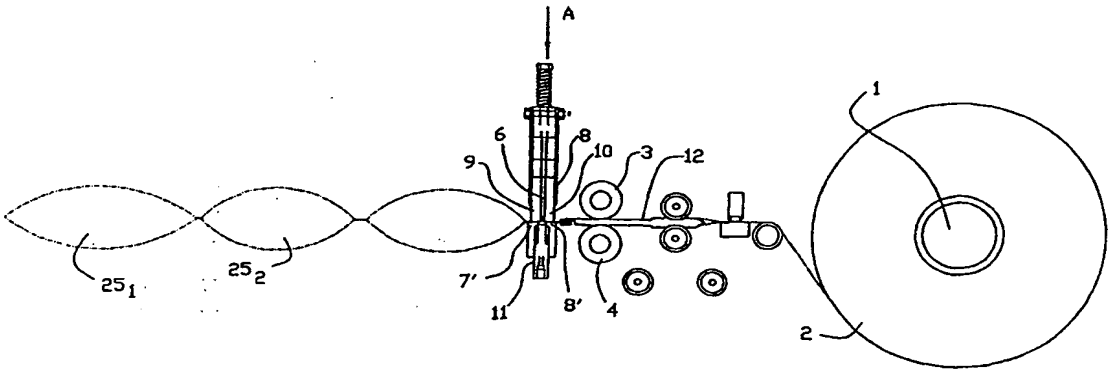

(57) Abstract

Machine for manufacturing pneumatically filled packing cushions (25) from a tubular plastic film (2) at a single processing station where perforations (14) are formed in the film (2), a gas is introduced into the film (2) through the perforations (14), and seals are formed on opposite sides of the perforations (14). The gas is introduced through an injector (11) and a plate (12) which is positioned within the film (2). The plate (12) is movable longitudinally within the film (2) between advanced and retracted positions relative to the injector (11), and has passageways (22) for directing the gas into the portion of the film (2) where a cushion(25) is being formed.

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MACHINE FOR MANUFACTURING PNEUMATICALLY FILLED PACKING CUSHIONS

This invention pertains generally to packing materials and, more particularly, to a machine for manufacturing pneumatically filled packing cushions.

International application WO94/07678 discloses apparatus for making small cushions or pillows which are filled with air for use as a protective filling material in packing fragile items and other objects in shipping cartons and the like. The cushions are made by forming a seal across the tubing, injecting air into the tubing through a needle which pierces the wall of the tubing, and then forming another seal across the tubing where the air was injected to close the cushion and seal the hole made by the needle. Successive cushions come out of the machine joined together, and they can either be left together and used in groups, or they can be separated and used individually.

In practice, it has been found that this system has certain limitations and disadvantages, and many of the cushions are not adequately filled with air. With the flexible tubing, it is difficult to punch the needle through one wall of the tubing without also punching through the opposite wall, and when that happens, air escapes through the second hole before the holes are sealed. If the second hole is outside the area which is sealed, the air will continue to escape even after the cushion is sealed. Moreover, in this system, the various process steps (*e.g.*, cutting, sealing, and introducing air) are performed at different stations or locations, which makes the

system rather bulky and limits the size of the cushions which can be made to the distance between stations.

It is in general an object of the invention to provide a new and improved machine for use in the manufacture of pneumatically filled packing cushions.

Another object of the invention is to provide a machine of the above character which is compact in construction.

Another object of the invention is to provide a machine of the above character which can manufacture cushions of different sizes.

These and other objects are achieved in accordance with the invention by providing a machine for manufacturing pneumatically filled packing cushions from a tubular plastic film which has a single processing station where perforations are formed in the film, a gas is introduced into the film through the perforations, and seals are formed on opposite sides of the perforations. The gas is introduced through an injector and a plate which is positioned within the film. The plate is movable longitudinally within the film between advanced and retracted positions relative to the injector, and has passageways for directing the gas into the portion of the film where a cushion is being formed.

Figure 1 is a vertical sectional view, somewhat schematic, of one embodiment of a machine for manufacturing pneumatically filled packing cushions in accordance with the invention.

Figures 2 - 4 are views similar to Figure 1 showing the machine in different operating positions.

Figure 5 is an enlarged, fragmentary view of the floating platen in the embodiment of Figure 1.

As illustrated in the drawings, the cushions are made from a flexible, heat sealable tubular plastic film such as high density polyethylene which has been flattened and wound into a supply roll 2 that is rotatively mounted on an axle 1. The axle can either be part of the machine, or it can be a separate device.

A pair of transport rollers 3, 4 draw the tubular film from the roll and feed it through the machine in the direction indicated by arrow 5. The two rollers are urged toward each other and into engagement with the film by a suitable spring or springs (not shown). The surfaces of the rollers have a coefficient of friction which is sufficiently high to provide a good grip on the film. A clamp 24 is engagable with the film to hold it in position.

Means is provided for forming at least one perforation in the film. In the embodiment illustrated, this means includes a knife 6 which has a plurality of teeth for forming a row of perforations in the film. That row extends in a direction transverse to the direction of film travel. Two pairs of jaws 7, 8 and 7', 8' are positioned next to the blade for clamping the film in a fixed position while the perforations are formed. In the embodiment illustrated, the blade is located between the upper pair of jaws 7, 8. In this embodiment, the lower pair of jaws 7', 8' is mounted in a fixed position, and the upper pair 7, 8 is movable between advanced and retracted positions relative to the lower pair. If desired, both pairs of jaws can be movable, and knives can be provided on both sides of the film.

To form the perforations without cutting through the film and severing it, the stroke of the knife is made less than the length of the teeth. If desired, the stroke can be increased so that the knife will cut through the film and sever it.

Air or other suitable gas (*e.g.*, oxygen, nitrogen or helium) is introduced into the tubular film through the perforations 14 which are formed by the knife. The means for introducing the air is positioned on the lower side of the film between jaws 7' and 8', and includes an injector 11 with at least one outlet opening 13 which communicates with the perforations.

A plate or platen 12 is positioned inside the tubing to facilitate the introduction of air. The plate has a relatively flat elongated body with generally planar upper and lower surfaces 15, 16 over which the film can slide. The plate is retained in position by a pair of holding rollers 19, 20 which are received in transversely extending slots 17, 18 in surfaces 15, 16. The fit between the rollers and the slots is such that the film can be drawn between the rollers and the plate while the rollers are holding the plate in place.

The lower surface of the plate includes a transverse groove 21 which forms a cavity or chamber in which injector 11 is received when air is being introduced into the tubing. A plurality of air passageways 22 extend between this chamber and the downstream end 23 of the plate to feed the air into the tubing.

The plate is movable between the retracted position shown in Figures 1 and 2, and the extended position shown in Figure 3. In the extended position, plate is positioned so that chamber 21 is aligned with the air injectors, and in the retracted position, the plate is positioned upstream of the perforating/injecting station. Movement of the plate between the two positions is effected by moving the holding rollers 18, 19 between advanced and retracted positions along the direction of film travel. The rollers are shown in the retracted position in Figures 1 and 2, and in the advanced position in Figure 3.

Sealing bars 9, 10 are located on either side of the knife for heating the plastic film to form seals adjacent to the row of perforations. These bars are positioned between the knife and the jaws 7, 8 on the upper side of the film.

Operation and use of the machine are as follows. In the transport mode illustrated in Figure 1, plate 12 is in its retracted position, clamp 24 and jaws 7, 8 and 7', 8' are all retracted, and the film is free to be drawn from roll 2 and fed through the machine by rollers 3, 4.

As illustrated in Figure 2, once the film has been moved the desired distance, rollers 3, 4 are stopped, jaws 7, 8 and 7', 8' are brought together, and clamp 24 is engaged with the film to hold it in place. With the jaws holding the film, knife 6 is lowered to form a row of perforations 14 across it, then raised or retracted out of engagement with the film.

The jaws are then retracted, and plate 12 is advanced to bring chamber 21 into registration with injector 11, as illustrated in Figure 3. The injector is then advanced into the chamber, and air or other suitable gas is introduced into the tubing through perforations 14. After passing through the perforations, the air passes through passageways 22 and is directed in a downstream direction to inflate the tubing and form a cushion 25.

Once the cushion is inflated, the injector and plate are retracted, and sealing bars 9, 10 are pressed against jaws 7', 8' as illustrated in Figure 4 to form a transverse seal on each side of the row of perforations.

If desired, knife 6 can be lowered to cut through the film and sever the cushion which has just been filled.

The invention has a number of important features and advantages. The perforating knife, the air injector, and the sealing bars are all located at a

single station, which results in a machine which is significantly more compact that prior art devices in which inflation and sealing are performed at different stations. Performing all of the functions at the same station also makes it possible for the machine to make cushions of any desired length by simply varying the amount of film which is fed into the machine for a given cushion. Figure 4, for example, illustrates the formation of cushions 25_1 and 25_2 of different length. Another significant advantage of the machine is that all of the cushions are inflated to substantially the same extent unlike prior art devices in which some of the cushions are not adequately filled.

It is apparent from the foregoing that a new and improved machine for manufacturing pneumatically filled cushions has been provided. While only one presently preferred embodiment has been described in detail, as will be apparent to those familiar with the art, certain changes and modifications can be made without departing from the scope of the invention as defined by the following claims.

CLAIMS

1. In a machine for manufacturing pneumatically filled packing cushions from a tubular plastic film:

a perforator for forming at least one perforation in the tubular film;

means for introducing a gas into the tubular film through the perforation;

sealing means for forming seals across the film on opposite sides of the perforation;

the perforator, the means for introducing the gas, and the sealing means all being located at a single processing station; and

means for advancing the tubular film in discrete steps relative to the processing station to form successive cushions.

2. The machine of Claim 1 wherein the perforator includes means for forming a row of perforations across the tubular film.

3. The machine of Claim 2 wherein the perforator includes a knife having a plurality of teeth for forming the perforations, and a set of jaws engagable with the film for holding the film while the perforations are being formed.

4. The machine of Claim 3 wherein a pair of jaws is provided on each side of the film, and the knife is positioned between the jaws on one side of the film.

5. The machine of Claim 4 wherein at least one pair of jaws is movable in a direction perpendicular to the surface of the film.

6. The machine of Claim 3 wherein the knife is movable over such a distance that the tubular film can be cut through and severed.

7. The machine of Claim 1 wherein the means for introducing the gas includes an injector which is movable between a retracted position away from the film and an advanced position closer to the film, the injector having at least one opening which is in communication with the perforation when the injector is in its advanced position.

8. The machine of Claim 7 wherein the perforator includes means for forming a row of perforations across the film, and the injector includes a plurality of openings which communicate with the perforations when the injector is in its advanced position.

9. The machine of Claim 1 wherein the perforator includes a blade and a pair of jaws on each side of the film for holding the film in a fixed position while the perforation is formed, the knife being positioned between the jaws on one side of the film, and the means for introducing the gas includes an injector which is positioned between the jaws on the other side of the film.

10. The machine of Claim 9 wherein the sealing means comprises a pair of sealing bars which are positioned between the blade and the jaws on one side of the film and which press against the jaws on the other side of the film.

11. The machine of Claim 1 wherein the means for introducing the gas includes a plate which positioned inside the tubular film and has at least

one passageway for receiving the gas through the perforation and directing the gas into the film.

12. The machine of Claim 11 wherein the plate includes a transversely extending chamber formed in one surface thereof for receiving the gas, and the passageway extends longitudinally from the chamber and opens through an end of the plate.

13. In a machine for manufacturing pneumatically filled packing cushions from a tubular plastic film: means for forming a row of perforations across the film, an injector movable between advanced and retracted positions relative to a surface of the film for introducing air into the film through the perforations, a plate positioned inside the tubular film having a transverse chamber in which the injector is received in its advanced position and a plurality of passageways which extend longitudinally from the chamber and open through an end of the plate, and means for moving the plate longitudinally within the film between an advanced position in which the chamber is aligned with the injector and a retracted position in which the chamber is withdrawn from the injector.

14. The machine of Claim 13 wherein the means for moving the plate includes a pair of rollers positioned outside the tubular film on opposite sides of the plate, and the plate includes transversely extending slots in which the rollers are received, the rollers being movable longitudinally of the film between advanced and retracted positions.

FIG. 1

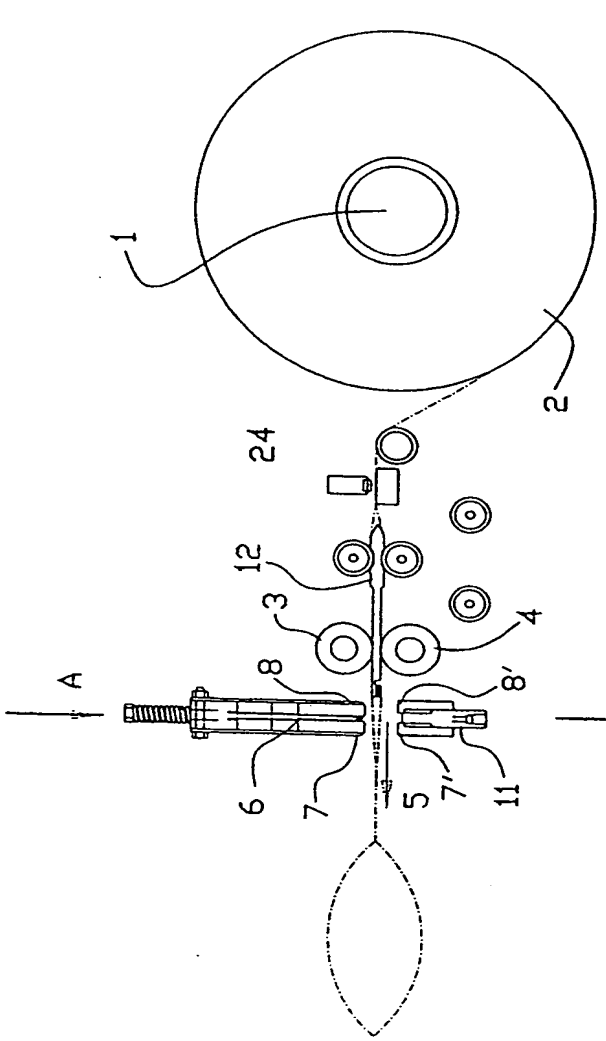
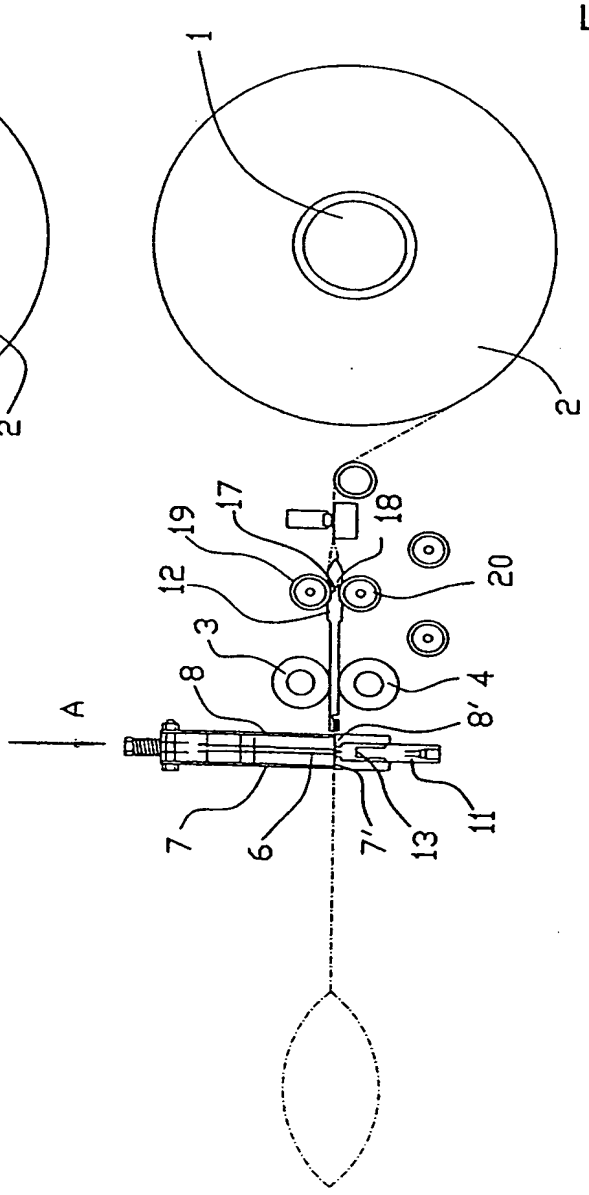


FIG 2



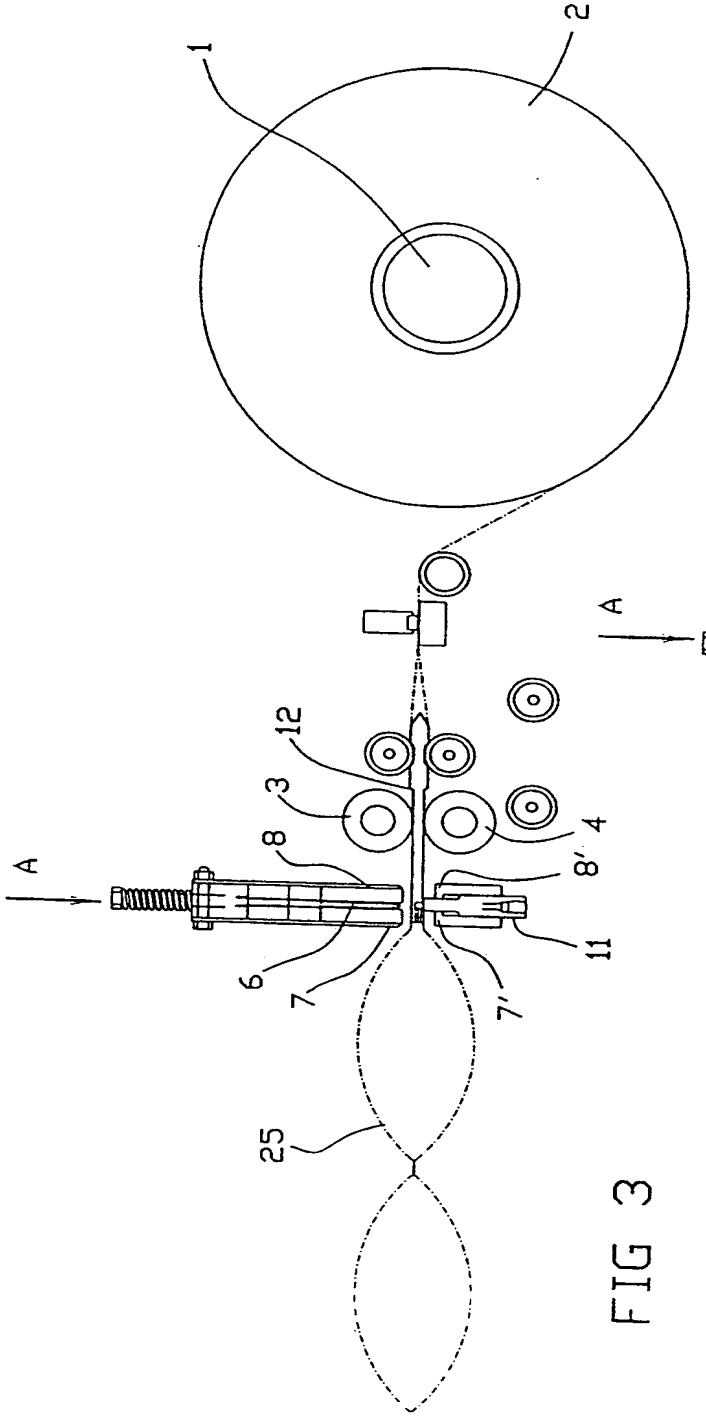


FIG 3

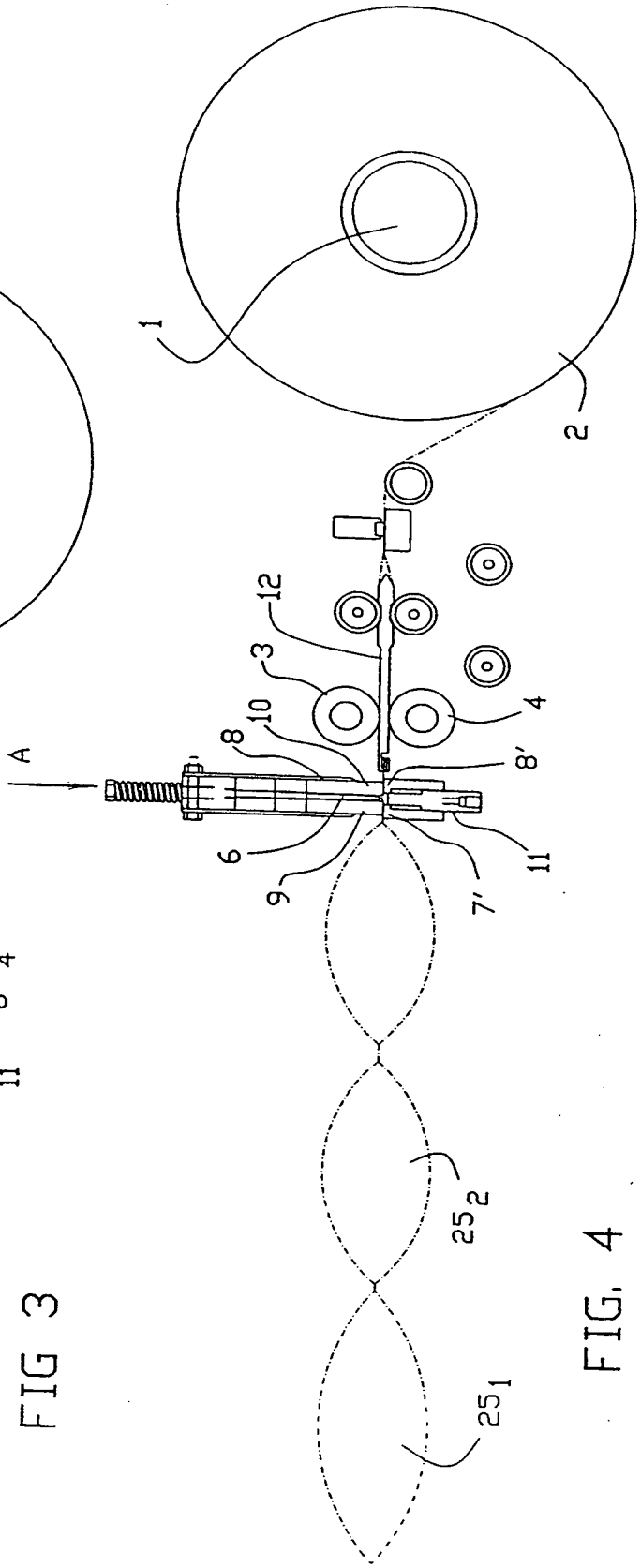


FIG. 4

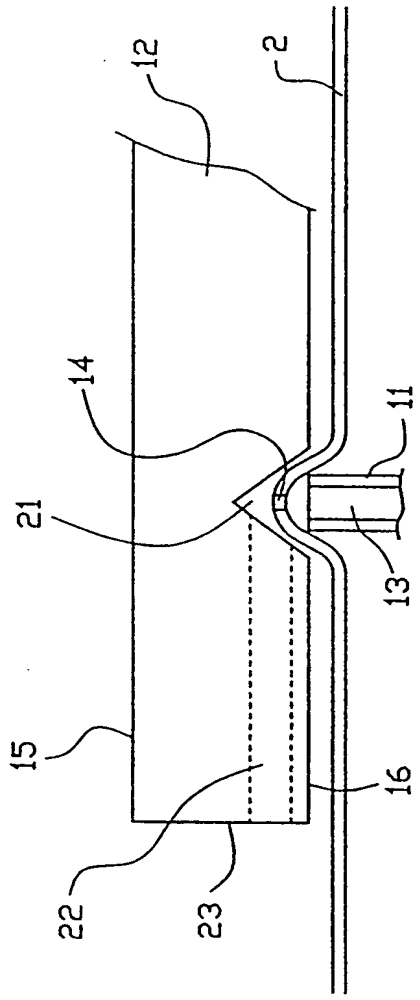


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/01303

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B65B 31/00, 9/10
US CL :53/79, 139.5, 567

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 53/79, 139.5, 567,403,472; 156/147

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

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none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,552,003 A (HOOVER et al) 03 September 1996, figure 4 and column 3, line 46 through column 4, line 15.	1,2,7,8
X,P	US 5,873,215 A (AQUARIUS et al) 23 February 1999, figures 3-5 and column 4, line 29 through column 5, line 43.	1-8,11-13
A	US 5,581,983 A (MURAKAMI) 10 December 1996, figure 2.	
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